

CASE REPORT

Incomplete tooth fracture following root-canal treatment: a case report

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Abstract

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Aim To demonstrate the need for proper restoration of root-filled teeth.

Summary Tooth fracture can be a sequel to root-canal treatment. It is associated with the removal of excessive amounts of the tooth substance during the instrumentation phase, the use of unnecessary force during obturation, or inadequate planning of the design of the eventual coronal restoration to include appropriate cuspal protection. Rarely, a fracture may be present in a tooth before treatment commences, but remains undetected. A case describing incomplete vertical tooth fracture of a root-filled mandibular first molar is presented.

Key learning points

- Failure to provide a root-filled tooth with a restoration incorporating adequate cuspal protection can lead to subsequent tooth fracture.
- Large intracoronal restorations should be avoided when restoring root-filled teeth, particularly when marginal ridges have been lost.

Keywords: restoration, root filling, tooth fracture.

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Introduction

Complete or incomplete fracture of root-filled teeth has several aetiologies. It may arise from the excessive removal of tooth substance during instrumentation of the root-canal system (Rosen 1982), followed by the exposure of the already weakened tooth structure to mechanical pressures during obturation (Pitts & Natkin 1983, Dang & Walton 1989, Morfis 1990, Borelli & Alibrandi 1999). Tooth fracture can also occur when root-filled teeth are exposed to significant occlusal force. Such structurally compromised teeth – which may have a reduced level of ‘protective’ proprioception (Loewenstein & Rathkarnp 1955, Randow & Glanz 1986) and are sometimes regarded as more brittle than natural teeth (McLean 1998) – are noted to be at risk of fracture development (Shillingburg *et al.* 1997).

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The final coronal restoration should be designed to include adequate cuspal protection (Rosen 1982).

Extensively restored teeth are more likely to develop fractures (Cameron 1964). As root-canal treatment is often performed on the teeth that have extensive restorations, these teeth should be investigated for existing fractures before commencing the treatment.

Tooth fractures impair the patient's masticatory performance. They also compromise the survival of root-filled teeth, as they may contribute to the progression of periodontal destruction in the presence of apparently successful root fillings (Polson 1977).

The following case describes the development of an incomplete tooth fracture in a root-filled mandibular molar.

Report

A 39-year-old female patient was referred to the Department of Restorative Dentistry, University Dental School and Hospital, Cork, Ireland. Following root filling of the mandibular left first molar 2 years prior to the referral, a radiolucency suggestive of a fracture in the furcation area was noted (Fig. 1). The tooth had been restored with an extensive four-surface (mesio-occlusal-distal-buccal) intracoronal restoration of a silver-reinforced glass-ionomer cement (Ketac-Silver, ESPE Dental AG, Seefeld, Germany). An 'overt' fracture had developed clinically on the mandibular first left molar, running from the buccal surface to the distal surface, along the margins of the restoration, separating the tooth into two distinct components (Fig. 2). The fracture extended subgingivally (Fig. 3) and was associated with an extensive periodontal defect (8 mm) on the buccal surface (Fig. 4). The patient had a history of recurrent abscesses in this area following the completion of root-canal treatment. Treatment options offered to the patient included hemi-section and subsequent crowning,

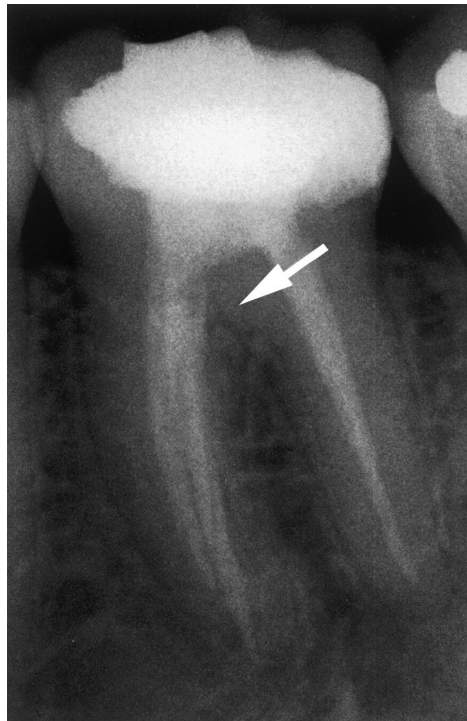


Figure 1 Radiolucency suggestive of a fracture line in the furcation area of a root-filled mandibular first molar.



Figure 2 Fracture of the mandibular first molar extending along the margins of the intracoronal restoration.

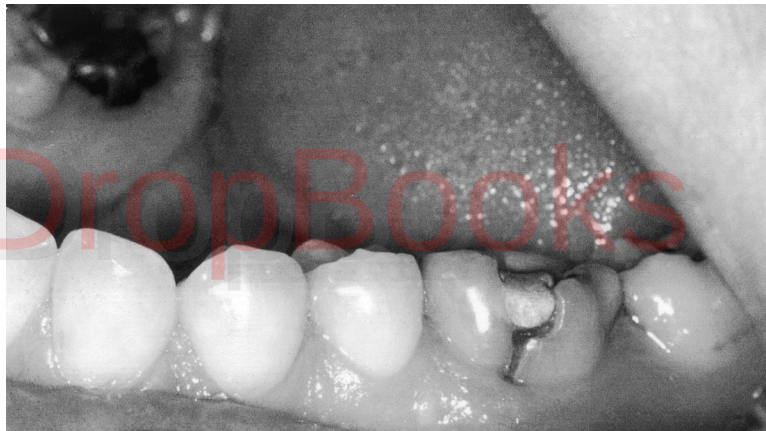


Figure 3 The fracture extending subgingivally on the buccal surface.

or extraction. The patient chose the latter option and the tooth was delivered completely. An incomplete vertical fracture was observed, extending from the crown on to the distal surface of the mesial root (Fig. 5).

Discussion

Complete or incomplete tooth fracture can arise in root-filled teeth unless adequate care is taken during preoperative assessment, during instrumentation and filling of the root-canal system, or in the design of the eventual coronal restoration. Whilst treatment is being performed, the root-canal system should be closely examined for evidence of any fracture. The operator needs to be aware of the risks of excessive removal of tooth substance during instrumentation and the exposure of such weakened teeth to mechanical forces during

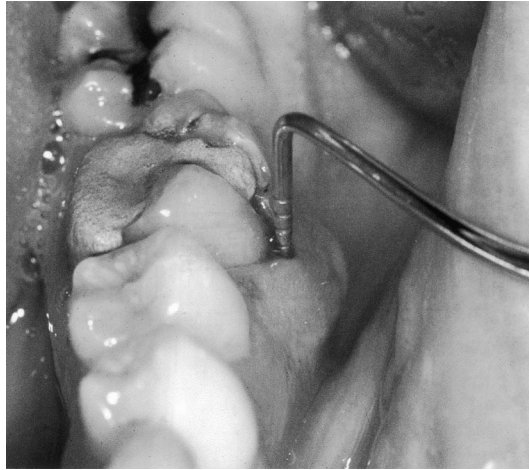


Figure 4 Detection of an 8-mm periodontal defect in the region of the fracture.



Figure 5 Following extraction, an incomplete vertical fracture of the tooth extending from the crown on to the distal surface of the mesial root was evident.

filling. Provision should be made for the tooth to be restored with adequate cuspal protection and mechanical strength immediately after completion of root-canal treatment, thereby preventing fracture initiation or propagation. Such restorations may take the form of a cast restoration, for example occlusal onlays, three-quarter crowns, or full-coverage crowns. The use of enamel-bonded and dentine-bonded composites (Wendt *et al.* 1987, Hansen & Asmussen 1990) or bonded amalgam restorations (Bearn *et al.* 1994) has been described. Root-filled teeth that have not been restored with an appropriate restoration have been shown to have a poor long-term prognosis (Ray & Trope 1995, Kirkevlang *et al.* 2000).

Conclusion

Restorations of the root-filled teeth should be designed with proper cuspal protection and should be provided soon after root filling. Failure to do so exposes the already structurally compromised tooth to the occlusal forces, which can result in the development of tooth fracture, as illustrated in the case described.

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